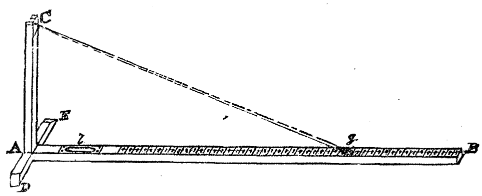
Under as recent a classification as that adopted by Lankester, in the new edition of the Encyclopaedia Britannica, this creature would form a new order, Amyaria, as opposed to the old Mono- and Dimy-aria. These orders being pretty generally given up, though not yet out of the text-books, it is probable that no others can yet be formulated. Whatever be its relations to the higher groups, a point to be determined by further study, there can be no doubt that the animal forms the type of a new family, Chlamydoconchae, and may take the name of Chlamydoconcha Orcutti. It is evident already, that the genus does nothing toward bridging the gap between the gastropods and pelecypods, but is simply a remarkably aberrant form of the latter group, and probably derived from some form with an external shell. It is able, according to Mr. Orcutt, by sphincter-like contractions of the mantle, to produce currents of water over the gills, which are probably finally ejected by the anal tube.

A paper on the subject, with figures, will be published shortly. WM. H. DALL.

Time without instruments.

Students usually feel little interest in the method of time in astronomy by 'a single altitude of the sun,' because they do not expect to own an instrument with which to measure the altitude. They can easily make the apparatus described below, by which, with careful handling, time may be found with a probable error of fifteen seconds.



Frame together the three pieces AB, AC, and DE, at right angles, — AB about sixty inches, AC eighteen inches and a half, and DE ten inches long, and each an inch and a quarter square. Cut a half-inch slit, one inch deep, in the end C, and in the direction AB. Fasten a piece of tin one inch square, with a hole an eighth of an inch in diameter, on the right-hand face of AC at C, with its hole opposite the centre of the slit. Set in a bubble at l by which to level AB. Let fall a perpendicular from the hole in the tin plate to AB; and at about twelve inches from the foot of that perpendicular commence the graduation on the centre line AB, dividing into inches and half-inches, and numbering 12, 13, etc., towards B. It will be well to paste a strip of drawing-paper on the face AB, on which to make the graduation.

Measure once for all the exact height in inches of the centre of the hole in the tin plate above the upper face of AB, which should be about eighteen inches, and multiply it by the decimal .9994358, which product designate by h. By using this for the height of AC, all altitudes will be corrected for mean refraction.

To use it, place in the sunlight, — best when the sun is not less than 16° nor more than 45° high, — with AB levelled by the bubble, estimating by eye when AC is perpendicular, so that the bright spot from the hole in the tin shall fall on the graduated centre line of AB. With watch in hand, read the hour, minute, and second when the centre of the elliptical bright spot is exactly on some dividing-line of the scale, and call the scale-reading r: then the sine of

$$\text{the sun's altitude} = \frac{h}{\sqrt{r^2 + h^2}} = \sin a.$$

For the hour-angle $= P$, the most convenient formula is, — letting $\delta =$ sun's declination, and $l =$ the latitude of the place, — $\cos P = \dfrac{\sin a - \sin \delta \sin l}{\cos \delta \cos l}$. This formula, with the known latitude (say, 36° 12′ 45″), may be put in the form

$$\log \cos P = \log \{\sin a - [9.77143] \sin \delta\} + a.\,c.\,\log \cos \delta + 0.09322.$$

A nautical almanac is needed for declination and the equation of time, though tabulated mean values of these for every tenth day of the year will answer for the usual accuracy required in common local time.

The form of apparatus may be varied to suit the taste of the student, or he may use the tin disk with a plumb-line suspended from it, in connection with a straight-edge levelled by a carpenter's level, and these of any lengths he chooses.

Time by 'equal altitudes of the sun' may be found by the same device.

A. H. BUCHANAN.

Cumberland university, Lebanon, Tenn., July 4.

Rotation experiments on germinating plants.

The opposite growth of the root and stem of a germinating plantlet, under other influences than that of gravity, we have recently shown by the following experiments. A circular trough (seen in section, $b\ b$, fig. 1) some sixteen inches in diameter and three

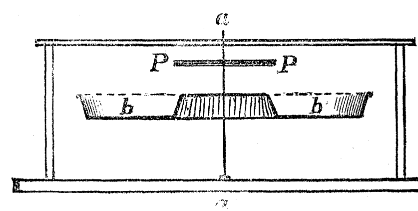
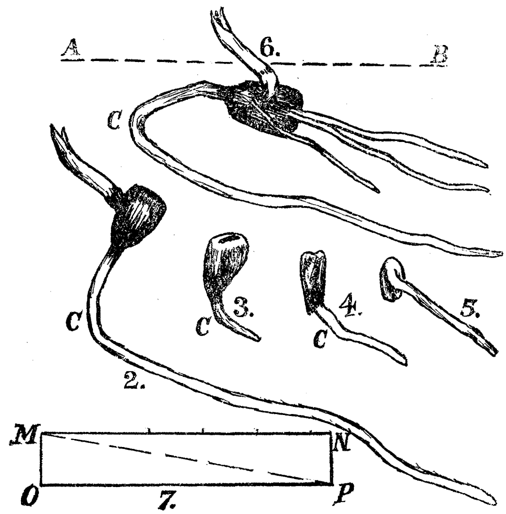


FIG. 1.

deep, rotates about the vertical axis $a\ a$. The trough, closely filled with earth, was planted with a quantity of well-soaked beans and seed-corn, and the whole covered with the fine gauze represented by the dotted lines. Forty-eight hours were allowed for the seeds to begin their growth, before the trough was started in rotation. By means of a Tuerk's motor, a uniform and continuous motion, at the rate of one hundred and eighty revolutions per minute, was then maintained for four days. At the end of this time the earth was carefully removed, and the positions of the young plants precisely noted. It was universally observed that the stems were accurately directed towards the axis, and the roots towards the circumference, of the trough. Figs. 2–6 represent several specimens. $A\ B$ is the horizontal, A being towards axis, and B towards circumference; those of figs. 2, 5, and 6, were at a radius of six inches from axis; figs. 3 and 4 had radii of five and four inches. The curves at the points C, C, C, C, are quite significant, being the points to which the radicals had extended before

rotation commenced. The direction of the stems can be well seen in figs. 6 and 2.

The cause of this mode of growth being, of course, the outward radial tendency of the plantlet in reaction upon the centripetal force acting through the



FIGS. 2–7.

soil, we may put the intensity of the new modifier equal to the centripetal acceleration, $\left(\frac{2\pi}{T}\right)^2 r$. This gives a centrifugal 'force,' so called, of 5,348 degrees, or 5.4 g, at a radius of six inches. If we put $M\,O$ (fig. 7) equal to gravity, and $M\,N$ equal to this centrifugal 'force,' then, for an ideal case, $M\,P$ will represent the resultant direction of the growing rootlet. This is but very loosely approximate to the observed positions, as might be expected.

CHAS. S. SLICHTER.

North-western university, Evanston, Ill., June 27.

Perforations in wool fibre.

In my investigations in wool fibre I have found some defective hairs that were perforated in places, evidently while growing on the sheep's back. As the perforations are perfectly circular, it would indicate that they are made by some creature at present unknown. Would it not be worth the while of some of your scientific readers to examine into the matter, and discover, if possible, what the perforator may be, and whether it is likely to remain as little injurious as at present?

JOS. M. WADE.

Boston, July 7.

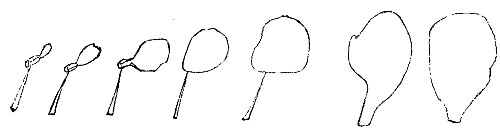
The evolution of petals.

In Mr. Grant Allen's interesting treatise on the 'colors of flowers,' the first chapter deals with the evolution of petals from stamens, in which the author shows that petals are but specialized stamens set apart for the purpose of attracting insects. His proofs are such that no candid reader is likely to finish the chapter, and apply its principles to the flowers he meets in his every-day walks, without being convinced of the correctness of the author's views. The gradual development from stamen to petal can be seen in most of those cultivated flowers which exhibit a tendency to become double, as well as in those which have already become so.

But it would seem that Mr. Allen had overlooked one point in the method of evolution. Throughout the entire book the idea is given that the process of evolution begins by the *filaments* becoming flattened. Thus, on p. 11, taking the English water-lily (Nymphea alba) as a typical example, the author says, —

"In the centre of the flower we find stamens of the ordinary sort, with rounded stalks or filaments, and long, yellow anthers full of pollen at the end of each; then, as we move outward, we find the filaments growing flatter and broader, and the pollen-sacs less and less perfect; next we find a few stamens which look exactly like petals, only that they have two abortive anthers stuck awkwardly to their summits; and finally we find true petals, broad and flat, and without any trace of the anthers at all. Here, in this very ancient though largely modified flower, we have stereotyped for us, as it were, the mode in which stamens were first developed into petals, under stress of insect selection."

Again, on p. 115, he says, "It has been objected by two or three authoritative critics, that the original petals need not have been yellow, because they represent the flattened filaments, *not the anthers*;" and the author goes on to show that filaments are usually of the same color as the petals.



FLOWER OF CYDONIA VULGARIS, SHOWING TRANSFORMATION OF STAMENS TO PETALS.

An examination of a number of our common flowers shows, that, in many cases at least, the evolution of the petal begins with the *anther* rather than the filament. Thus, in the common quince (Cydonia vulgaris), many of the flowers possess stamens of which the anthers have become petaloid, while the filaments are of the normal type. Some of the anthers are merely flattened on one end; others are more so; while in others the anther has become a flat, white, petaloid disk on the end of a normal filament. From this, every gradation can be seen to the normal petal. In this instance, not only the pollen-walls, but the pollen itself, has become petaloid before the filament has been at all modified. In the flowers of the mock-orange (Philadelphus coronarius) the same transition often occurs, as well as in many of the double flowers of our gardens and conservatories.

CLARENCE M. WEED.

Agricultural college, Lansing, Mich.

Metallic circuits in cables.

When the full text of Mr. Gisborne's paper, read before the Royal society of Canada, is published, it will be shown that his anti-induction experiments with all metallic circuits in underground cables were made in connection with an electric target, for which a prize medal was awarded to him at the London exposition of 1862; and the diagrams attached to his paper will also explain why parallel metallic circuits in a *multiple* cable, unless twisted according to his design, will *not* eliminate induction of currents in